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Comparison of heart rate monitor and accelerometer for measuring energy expenditure under field conditions

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Abstract:

Life history models predict differential energy allocation patterns among growth, maintenance, and reproduction under varying ecological conditions. The assessment of energy expenditure is one important tool in quantifying energy allocation; activity is more immediately modifiable than endocrine or genetic factors. In a pilot project among subsistence agriculturalists in The Gambia, West Africa, we tested the efficacy of accelerometers against heart rate monitors for measuring energy expenditure in free-living Gambian women. While accelerometers are light, do not require contact with the skin, and may be programmed to start and stop at predetermined times, they record movement rather than exertion. Both devices were calibrated to oxygen consumption, and individual regression lines for energy produced in Watts were computed. Women wore heart rate monitors and hip and arm accelerometers for approximately twelve hours, during which they were observed for two hours, and activity and intensity level were recorded.

Results indicate that, in this sample, an accelerometer worn on the hip is as effective as heart rate monitoring in measuring energy expenditure. Though activity counts spike more easily than heart rate, a rolling average of activity counts yields a qualitatively comparable energy expenditure curve to heart rate. Accelerometer activities recorded at the upper arm and the hip were generally concordant, but showed significant periods of divergence. Focal observations suggest that certain typical activities may be missed by one accelerometer location or the other. We conclude that differences in energy expenditure between individuals and between groups can be obtained in field conditions using hip accelerometers.